when the heart has ceased to supply blood to the pulmonic capillaries, during the period previous to coagulation, the blood may be driven or drawn over the pulmonic circuit, may be oxidized in its course, may reach the left side of the heart, may be distributed over the arteries, and that, thus distributed, it possesses the power of restoring general muscular irritability and the external manifestations of life. Hence I infer that resuscitation, under the limitations named, is a possible process, and that it demands only the elements of time, experiment, and patience for its development into a demonstrable fact of modern science.

Various modifications of the experiments to which I have had the honour to draw the attention of the Society are in hand; and if I am allowed the privilege, they will form the subject of another communication.

XIV. "On the Anatomy and Physiology of the Nematoids, parasitic and free; with observations on their Zoological Position and Affinities to the Echinoderms." By Henry Charlton Bastian, M.A., M.B. (Lond.), F.L.S. Communicated by Dr. Sharpey. Received June 13, 1865.

(Abstract.)

After commenting upon the many conflicting statements which have been made concerning the anatomy of these animals, and more especially with regard to the presence or absence of a nervous system, and of real organs of circulation, the author alludes to the increased interest which has lately been thrown over this order by the discovery of so many new species of the non-parasitic forms, marine, land, and freshwater.

He has entered fully into the description of the tegumentary organs, and has recognized a distinct cellulo-granular layer intervening between the great longitudinal muscles and the external chitinous portion of the integument. This layer is one of great importance in the economy of these animals; the author looks upon it as the deep formative portion of the integument from which the chitinous lamellæ are successively excreted. It is bounded internally by a fibrous membrane, which serves as an aponeurosis for the attachment of the four great longitudinal muscles; and the well-known lateral and median lines which have so long been a puzzle to anatomists are, he says, in reality nothing more than inter-muscular developments of this layer. In some species each of the lateral lines contains an axial vessel, though in very many others nothing of this kind is to be met with. A periodical ecdysis of the chitinous portion of the integument takes place in all Nematoids during the period of their growth.

The author agrees with Dr. Schneider as to the nature of the transverse fibres attached to the median lines. They are contractile prolongations from the longitudinal muscles, and may be considered extrinsic muscles for the propulsion of the intestinal contents, since the intestine itself has no muscular tissue in its walls.

Schneider's description of the nervous system in *Ascaris megalocephala* has been confirmed, and a similar arrangement has been recognized by the author in several other Nematoids. It exists as a nervous ring encircling the commencement of the œsophagus, in connection with many large ganglion-cells. The principal peripheral branches are given off from the anterior part of the ring, and proceed to the region of the mouth and cephalic papillæ. Although well developed ocelli exist in many of the free marine species, no nerve-filaments have yet been detected in connexion with them.

The organs of digestion are mostly simple, the principal variations being met with in the presence or absence of a pharyngeal cavity, and in the structure of the œsophagus. In some species its parietes are distinctly muscular, whilst in others, as in the *Trichocephali* and *Trichosomata*, they are as distinctly cellular. Those possessing a pharyngeal cavity sometimes have well-marked tooth-like processes developed from its walls; but the author believes that the chitinous plates which are sometimes met with in posterior swellings of the œsophagus are not "gastric teeth," as they have been hitherto described, but rather valvular plates for ensuring greater perfection in the suctorial process by which these animals pass their food along this portion of the alimentary canal.

The water-vascular system may be seen in many Nematoids in its most elementary condition, as a small tubular gland, with an excretory orifice in the mid-ventral region of the anterior part of the body. In other Nematoids no trace of such a system exists; whilst its most developed condition yet recognized in these animals may be seen in *Ascaris osculata* and *A. spiculigera*, where an intimate plexus of vessels, still in connexion with an anterior ventral pore, is met with in a peculiar development from the left lateral band. Intermediate conditions between these extreme forms may be traced in other species; and from the obviously glandular nature of the tubular or pyriform organ met with so commonly in the free, and also in many of the parasitic species, he thinks considerable light is thrown upon the function of the "water-vascular" system. He says, "Here we have undoubtedly to deal with an excretory glandular apparatus. No one could for a moment regard these structures as at all analogous to vessels destined alternately to receive and discharge an external fluid medium. I believe that in the *Trematoda* and *Tæniada* also, where similar though often more developed systems exist, their function is in like manner one of a purely eliminatory kind; and I therefore cannot but look upon the name of 'water-vascular' apparatus as a singularly inappropriate appellation for this system of vessels."

Other very peculiar transverse vessels exist in the deep integumental layer of *Ascaris megalocephala* and *A. lumbricoides*, mostly running in pairs from median line to median line, and, strangely enough, being about twice as numerous on the right as on the left side of the body.

The author believes that in the Nematoids but little provision exists for

the oxidating portion of the process of respiration, and thinks that this deficiency may be compensated by a greatly increased activity of glandular *eliminating* organs. Considering the conditions under whose influence so many of the parasitic forms pass their existence, we can easily imagine that the presence of any organs for effecting an oxidation of their tissues would not only be useless, but actually baneful. Glandular organs exist in the greatest abundance in all Nematoids, and many of these are excretory organs. In those species in which no modification of the ventral excretory apparatus is met with, the author has found a very large number of channels running through the chitinous portion of the integument, so as to bring its deep cellular layer in communication with the exterior. These pores are, he believes, complementary respiratory organs, and their development is always in an inverse proportion to that of the other excretory organs. Thus amongst the free Nematoids he has found them most numerous in *Dorylaimus stagnalis* and *Leptosomatum figuratum*—species in which the ventral excretory apparatus is entirely absent. The same arrangement is met with in the *Trichocephali* and *Trichosomata*, in which these integumental channels attain their maximum development. The gradually widening longitudinal band long known to exist in the *Trichocephali* is due to the presence of thousands of these channels in connexion with a glandular development of the deep integumental layer beneath.

Many interesting facts are brought forward concerning the "tenacity of life" of some of the free Nematoids, and their power of recovery after prolonged periods of desiccation. This has been long known as one of the characteristics of *Tylenchus tritici**, but the author has found it common only to the species of four land and freshwater genera,—*Tylenchus*, *Plectus*, *Aphelenchus*, and *Cephalobus*. The remainder of the free Nematoids are remarkably frail, and incapable of recovering even after the shortest periods of desiccation.

In the last section, on "The zoological position and affinities of the Nematoids," the author enters fully into what he believes to be the points of resemblance between these animals and the Echinoderms. The strongest evidence is, he thinks, to be found in the fact of the very close resemblance between the nervous systems of these animals, differing notably as it does at the same time from what we find in the *Scolecida* or *Annelida*. Then the integumental pores which he has now discovered in so many Nematoids can, he thinks, be paralleled only by the ambulacral and other pores met with in the Echinoderms. Great similarities in the distribution of these pores may also be observed in the two groups. The Nematoids present no trace of segmentation or lateral appendages to their bodies, but traces of a radiate structure do exist. Their various parts and organs exhibit a quadrate mixed with a ternate type of development. He looks upon the order *Nematoidea* as as aberrant division of the class *Echinodermata*, which at the same time tends to connect this class in the most interesting

* *Vibrio tritici* of older writers.

manner with the *Scolecida*—since, although in the points above mentioned they display their affinities to the Echinoderms, still, as regards the structure and different modifications of the ventral excretory apparatus, they agree more closely with the *Trematoda* or flukes.

XV. "On the Development of Striated Muscular Fibre." By Wilson Fox, M.D., Professor of Pathological Anatomy in University College, London. Communicated by Dr. Sharpey. Received June 15, 1865.

(Abstract.)

The discrepancies in the statements made by various observers on the structure, as illustrated by the history of the development, of striated muscular fibre, have induced the author to submit the question to a renewed and independent investigation. He has examined the process in the tadpole, the chick, the sheep, and in man, and with results which correspond very closely in all these classes. The investigation is most easy in the tadpole, as the early structures are of much larger size; but observations are made with a comparatively greater precision when high magnifying powers are employed. The author has used 900 linear in his observations on the tadpole, 1250 or 1850 linear in his observations on the chick and mammalia. The earliest form in which muscular tissue appears in the tadpole is an oval body containing one or more nuclei, and densely filled with pigmentary matter. This body has a well-defined outline, which induces the author to regard it as a cell, though he has not succeeded in isolating any distinct membrane. Such bodies then increase in length with or without multiplication of their nuclei, and after a short period a portion of their structure loses in great part its pigment and exhibits a striation sometimes transverse, sometimes longitudinal, or occasionally both conjointly; but there is no distinct line of demarcation at this stage between the striated and non-striated portion of the cell-contents,—showing that the change takes place within the contents of the cell.

As the pigment gradually diminishes in the non-striated portion of the cell-contents, a membrane can in some cases be very distinctly observed limiting the whole structure, while in others it can only be seen around the non-striated portion, and in the former case the presence of a striated structure within this membrane is very distinct. The nuclei are always found situated in the granular non-striated portion of the contents of the cell.

The cell may elongate to a very long fibre, to which only a single nucleus may be attached, or in the process of elongation a great increase in the number of nuclei may take place. In all cases the nucleus and fibre are enclosed by a membrane, which the author regards as an extension of the original membrane enclosing the cell in its earlier stages. The thickness of the striated portion appears to be in direct proportion to the number of nuclei enclosed within the membrane.

With the advance of development the space occupied within the mem-